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INJECTION TREATMENT OF VARICOSE VEINS

by

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Senior Thesis, 1933
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INJECTION TREATMENT OF VARICOSE VEINS

The treatment of varicose veins by the injection method has, within recent years, become quite popular. However the injection method is not new. Pravaz, the inventor of the hypodermic syringe, first used the method while he was attempting to cure aneurysm by the injection of ferric chloride. This was in 1851, and the same year Desgranges and Valette carried out the treatment with a certain measure of success in cases of varicose veins. In 1853 Chassaignac and Follin were using the method in Paris and showed cases at the Societe de Chirurgie, but the former reported fatalaties, chiefly from septic complications. Broca was still using ferric chloride in 1860, and it was not till 1884 that the substance was abandoned, as the result of fatalities reported by Weinhehner, after he had treated 32 cases, 18 of which developed gangrene and 1 an abscess. The accidents arose from two causes: firstly, ferric chloride was a coagulant of blood, and secondly, sepsis was frequently introduced at the time of infection.

In 1854 Soquet, professor of pharmacy at Lyons, introduced iodo-tannic solution, and this was employed successfully by Desgranges and Barrier, who reported 16 cures in that year without accident. The thrombi produced by this method were firm, but the cramp was severe and caused the patient to be in bed for some time. Other substances tried at this time included chloral hydrate and persulphate of iron. After 1876 perivenous injection of varicose veins became popular because there was less danger from septic complications than with intravenous methods. This

was the treatment for varicose veins, hemorrhoids, rectal prolapse, and varicocele.

English, Marc See and Broca used alcohol injections in treatment of varicose veins. As late as 1894, Delore was defending the use of iodo-tannic methods. But about this time operative methods became more popular and intravenous methods came into disfavor.

At the beginning of the present century, Tavel of Berne, Switzerland, used 5% phenol injections, but combined with this treatment the ligation of the saphenous vein at its proximal end. This method met with relative success. Schiassi of Bologna in 1908 used an aqueous solution of iodine and potassium iodide injected distally, but he also resected a portion of the saphenous vein. Borchards in 1910 discovered that intravenous salvarsan cured varicose veins. In 1911 Professor P. Linser of Tübingen, Germany, noticed that the use of mercuric chloride in the treatment of syphilis, caused a sclerosing action on the vein. He used mercuric chloride in some six thousand cases and in 1923 changed to the safer solution of 20% sodium chloride. In 1913 Hanschell, as a result of experiencing a thrombosis action with quinine in treatment of malaria used this drug in the treatment of varicose veins with success. Then again we have a short period of disfavor for this treatment. People thought success was a matter of luck rather than knowledge. In 1916-17, Professor Sicard of Paris observed that the intravenous injection of luargol obliterated the veins. He analyzed the solution and found that the free soda caused the sclerosing action. In 1918, he found that neutral sodium carbonate acted successfully in sclerosing veins, but because of extensive sloughing in the subcutaneous tissues, soon changed to

the less toxic sodium salicylate. This solution is still used by many and we will credit Sicard with its first use. Nobl of Vienna has confirmed Professor Linser's work with mercuric chloride. Genevrier in France has popularized the use of Quinine and urethane. (1) Kausch used invert sugar solution with good results and it was later popularized by Nobl. In 1921, Nobl introduced the use of 50-60% glucose. The injection of varicose veins was first introduced in this country by Kretchmeier, 1920, who came to this country from Germany. He did his first work at Red Wing, Minnesota, in the clinic. He left no record of his work but some of his patients went to the outpatient department of the University of Minnesota for continuation of the treatment. His results seemed far in advance of anything that had been done in this country. So after reviewing the literature, Hayes (4) and his fellow workers began this work in 1922 at the University of Minnesota. The two solutions used at first were bichloride of mercury and sodium salicylate. Wright in 1930, (17) reported the use of sodium morrhuate, which has been used at the Mayo Clinic for nearly two years, and has been found very satisfactory.

To give some idea of the number of cases that have been reported in the literature, and most of them with good results, I shall enumerate the major series of cases. Linser 6000, Genevrier 4000, Nobl 3000, Donthwaite 2000, Gaugier and Sicard "several thousand". (2) Schmier reports on approximately 3000 cases; Hayes 1000, White 750, Logefeil 500, deTakats 389, Kilbourne collected 4607 cases, McPheeters and Rice reported on 53000 cases reviewed, which included most of the cases in the literature up to 1928; Pennoyer 218 cases, Riehl 1000 cases with good results; Zimmerman 600 patients, Levi 4000 injections,

Wright 478 cases, Angle 2500 injections, Matyas 200, Cavallucci 156 cases, Gillespie and Strobel 405 injections, Ferguson and Loefflad 72 cases, Steubner 104 cases and Heineck 300 cases.(3) Of all these cases reported there have been only 11 deaths from pulmonary emboli. This however is not a correct figure for fatalities occurring after injection, because I personally know of one fatality in Nebraska which to my knowledge has not been reported. This case and three I have heard about in Iowa, make me wonder how many men beginning the use of the injection method have fatalities they do not report. I do not blame these men because I sincerely believe, that when I begin practice, should my first case be fatal, I would remember the many thousand cases I have reviewed with a relatively low mortality, and be inclined to neglect reporting the case for fear of it being a blight on my reputation as a beginning physician. And again I would be inclined to think I was at fault. I merely mention this to show that the injection of varicose veins is not without its dangers, and that the men doing injections should be trained for it the same as our surgeons are trained. I am thoroughly convinced that the injection method is less dangerous to the patient, and should be used instead of excision, and I hope to bring out in this paper the indications and contraindications for injection treatment; advantages and disadvantages of the most popular solutions; the technique in injecting these solutions; the pathological changes that take place in the vein after injection; the complications following injection and recurrences that have been reported.

Probably what brings patients for treatment more than anything else is large varicose ulcers of the leg. Many of these patients have gone from clinic to clinic with little relief.

They have tried rubber stockings, bandages, unna paste, and all forms of patent medicines advertized. It is this type of patient who should be given credit for the popularizing of the injection treatment, because he was willing to try anything for relief. When Hayes (4) began the work he selected only the most refractory patients. Now people are becoming more educated to the use of injection and are presenting themselves before the condition is so severe.

A general examination is necessary for all patients with varicose veins or ulcers. One should search for symptoms of cardiac or cardiorenal dysfunction, such as marked dyspnea, definite bilateral edema, and the anginal syndrome. Acute thrombophlebitis occurring after severe illnesses should not be overlooked. This is best brought out by various tests such as the Trendelenberg, Perthe, and the binding of the leg from the toes up and having the patient walk several blocks. If definite discomfort is experienced obstruction of some part of the deep circulation must be considered. Inspection should be made for enlarged veins over the abdomen, radiating from the superficial epigastric vein, which communicates with the lateral thoracic vein, forming the thoracico-epigastric. Such enlargement indicates some degree of occlusion of the femoral or iliac vein. Patients giving a history of unusual sensitiveness of their feet to lowered temperatures, or of intermittent pain in the legs, may have arterial disease, functional or organic, and should not be considered suitable for sclerosing treatment. It is thought that the venous side may become affected the same as the arterial side. It is quite generally accepted that patients with acute infections, colds, hyperthyroidism and recent operations, especially for pelvic conditions, should not be injected. Recent operations on the uterus followed by radiotherapy, have the same

significance as other pelvic operations and it is these cases that are prone to pulmonary embolism. Venous stasis caused by a deformity may be mistaken for varicose veins, and the orthopedic clinic should be consulted before injection of this type of patient. Patients with hypertension and secondary circulatory disturbances should be considered unfit for injection. (5)(6) Pregnancy is not a contraindication to injection but one should never use quinine in treatment of these patients. Usually if it is the first pregnancy, the patient is carried along until after birth of the child, but Hayes (4) says he does not hesitate to inject them during later pregnancies. This is quite general with all the men doing injections. Diabetes is not considered a contraindication if the patient is sugar free. Nephritics are treated if they do not have marked symptoms.

Let us summarize the contraindications as follows:

- (1) After acute phlebitis, no injections within two years.
- (2) Intermittent claudication.
- (3) Deep thrombosis due to any cause.
- (4) Phlegmasia alba dolens. (6)
- (5) Hyperthyroidism.
- (6) Active tuberculosis.
- (7) Mechanical obstruction causing edema.
- (8) Pelvic operations, no injections within two months.

Kilbourne (32) uses a complete and concise method of examination before injection.

HISTORY

Name -----
 Address -----
 Age -----
 Age when V.V. began -----

PHYSICAL EXAMINATION

Temperature ---- Pulse ----
 Blood Pressure -----
 Do veins extend above inguinal
 region or abdomen -----

Pain ----- For how long	Edema of leg -----

Inflammation in leg	Pulsation of artery dorsalis
Phlebitis or milk leg	pedis -----
When -----	Of tibial posterior -----
Typhoid -----When -----	Cyanosis or rubor when foot
Pelvic troubles -----	dependent -----
Intermittent claudication -	Pain or blanching of toes when
-----	leg is elevated and ankle is
Ever taken quinine with symptoms	alternately flexed and extended?
of toxemia? -----	Sclerosis in veins -----
	Pain on walking with legs ban-
	daged -----
	Description of veins -----
	Pelvic tumors -----
	Pelvic infection -----
# Urine ---- Specific gravity ---- Albumin ---- Sugar -----	

The important thing to remember is to do a complete physical examination in every case before injection is made. Many of the indications and contraindications can be modified as the judgement and the experience of the operator becomes more mature. In order to preserve this treatment which has brought comfort to so many patients who have been suffering for years, it is best for the beginner to use the strictest precautions and then modify these precautions as his confidence increases.

The types of veins found are well described by their names: saccular, tortuous, uniformly dilated, and fine cutaneous stellate or horse hair variety. Schmier (8) describes another type of vein, the penetrating type. This vein can be practically inverted by the examining finger, the finger actually entering into the communicating vein. This is indicative of a valvular deficiency in the

communicating vein between the superficial and deep systems, with a resulting dilatation of both. Because of this valvular deficiency the two sources of increased venous pressure readily dilute the sclerotizing solution and make the veins difficult to treat.(8)

What qualities should a sclerosing solution have to make it advantageous for injection treatment? First, it should produce a firm thrombus; second, it should not be so irritating that if some of the solution is spilled outside the vein a slough will be produced; third, the pain and cramp must not be too severe or the patient will not come back for further treatment; and fourth, the systemic reaction should not be severe. There are about six solutions being used now that I shall discuss and give the advantages and disadvantages of each. Many more solutions have been used during the history of the injection treatment but sodium chloride, sodium salicylate, quinine and urethane, 50% dextrose, 50% dextrose and 30% sodium chloride, and sodium morrhuate seem to be the most popular ones at this time.

Sodium chloride, 20% solution, gives excellent and rapid results. It does give a very disagreeable cramp accompanying the injection and the slough is extensive if there is any perivenous injection, or even if there is slight leakage of the solution into the perivenous tissue. Schmier (8) who in 1930 had done about 3000 cases with 10000 injections recommends sodium chloride because he thinks it the safest and the most certain in effect. For the large saccular veins and the uniformly dilated ones he thinks no other solution better. In amounts up to 20cc of 20% solution, definite chemical action can be insured on the vein without being sufficiently diluted by the blood volume. Schmier does not deny the fact that sodium chloride causes a severe cramp and that one drop outside the vein

will cause a slough. Smith (9) also states that sodium chloride may give rise to a general reaction manifested by sensations of dizziness, faintness, and warmth in the throat.

Sodium salicylate was first used by Sicard in 1918. With this solution it is best to start with solutions below 20% and to work up. The advantages are that it produces a limited sclerosis and causes obliteration of two or three inches of vein wall. The clot is firm and well adhered to the wall. The disadvantages are about the same as those of sodium chloride. The injection is very painful and is accompanied by severe cramps in the calves. If any fluid gets into the subcutaneous tissue, a gangrenous slough followed by ulceration usually occurs. A very small quantity in the tissues will cause this condition. (6) De Takats (7) stated in 1931 that salicylates were poorly tolerated by some, but Lewis (10) in over 800 injections did not observe this in any of his cases. In 845 injections with sodium salicylate 30-40%, 807 showed good thrombosis or 95.5%, 38 or 4.5% showed poor thrombosis and there were 11 sloughs. His observations showed that sodium salicylate 30-40% gave the best results. He, however, gave it up for quinine and urethane because of the severe cramp of the salicylates. The same observations regarding sodium salicylate had been made by Kilbourne, McPheeters and Rice, De Takats and others who have done the most work in the injection treatment. Personally, I feel that in present day medicine we must find a solution that causes less pain to the patient and one in which there is less danger of slough. Many men have felt that 50% dextrose will meet these requirements.

Nobl in 1921 introduced the use of 50-60% glucose. De Takats (11) in this country reported very favorable results in 1930 with the use of 50% glucose. After trying sodium chloride, sodium salicylate, and quinine and urethane, he decided that 50% glucose

was the best. There is no danger of necrosis, scarcely any cramping following the injection, no systemic reactions, and the reaction in the vein is confined practically to the intima. 50% glucose however tends to produce a clot over a large area of the vein and the clot is not solid. The treated vein is tender for five or six weeks. There is a tendency for the clot to loosen and the majority of fatalities recorded have occurred after the injection of glucose. Glucose will not sclerose large dilatations. After De Takats (11) had reported favorable results with glucose, he changed to 50% glucose and 30% sodium chloride upon the suggestion of Kern and Angle (12). So in 50% glucose, because of its dangers, we still do not have the favorable solution.

After rather extensive experiments performed on dogs with sodium chloride, sodium salicylate, 50% dextrose, and 50% dextrose 30% sodium chloride, Kern and Angle (12) came to the conclusion that 50% dextrose-30% sodium chloride in equal parts was the most favorable solution. Their report is based on only 104 patients, but the results were very satisfactory. If any of the solution escapes while the injection is being done, the patient complains of a burning sensation which is moderately severe. There is an area which is painful and red, but they have never had a slough. If hot compresses are applied, all pain and inflammation will leave in from forty-eight to seventy-two hours. De Takats (7) verifies the work of Kern and Angle and said in 1931 that 50% dextrose--30% sodium chloride in equal parts was the best solution. He thinks dextrose too bland and sodium chloride too irritating, but the mixture combines the advantages and lacks the disadvantages. At that time he did not like quinine because it was poorly tolerated by some patients. He, however, stated that further improvement of dextrose and sodium chloride mixtures was desirable because if there

were less cramping and less of the solution could be used, more injections could be made at one sitting and this would shorten the course. McPheeters, Merkert and Lunblad (13) use several solutions according to the type and size of the vein. For thin walled veins they use mild solutions such as invert sugar, for large saccular veins, dextrose and sodium chloride, and for the pick ups, quinine and urethane solutions.

All who have reported on the use of 50% dextrose--30% sodium chloride in equal parts have found it favorable. I have seen no unfavorable reports of it except for a cramp at injection which is not severe and the statement by De Takats (7) that it still was not the ideal solution and could stand some improvement.

Quinine and urethane is the next solution I wish to discuss. Genevrier started its use. It is quite generally agreed that this solution produces favorable results in injection treatment, but it cannot be used during menstruation or pregnancy and in a few patients it is poorly tolerated. Klbourne, Dodson and Zeiler, (14) who have done probably the best and most recent experimental work on solutions, have evaluated these solutions from the standpoint of toxicity, slough producing properties, and bactericidal properties, state that quinine and urethane is highly efficient as a sclerosing agent and is bactericidal to staphylococcus aureus. It has a perfect mortality record, possibly due to its bactericidal action in preventing phlebitis and embolism. It causes no pain at the time of injection and if the leg is kept bandaged, the occasional pain the next day is usually prevented. It, however, does cause a slough when there is leakage outside the vein. There is no warning of this leakage, as there is with some solutions, by pain at the time of injection. This leakage can be prevented

by pressure with the finger along the tract of the puncture. Because of its perfect mortality record, these men regard quinine and urethane the solution of choice, except in superficial, thin walled veins, provided it is used by those sufficiently experienced to prevent extravascular escape. Lewis (10) used quinine and urethane in 2075 injections, got good thrombosis in 1969 injections, poor or no thrombosis in 106 injections, and 24 sloughs. This made the percentage of good thrombosis 94.8, and that of poor or no thrombosis 5.2.

In all his injections with quinine and urethane, Lewis (10) got constitutional reaction in only one case. This patient became faint, pallid, nauseated and then vomited, but was all right in ten minutes.

Weeks and Mueller (15) in a report of 325 cases, in which they used various solutions, I have named previously, selected quinine and urethane as the best solution. They chose it because of sureness of results and because of the absence of cramp. Their observations regarding sloughs coincide with those of Kilbourne and of Lewis. If one can become efficient enough in the injection of this solution that he does not get any perivascular leakage, I am satisfied that this is the best solution we have discussed thus far. But let us consider sodium morrhuate which has become popular at Mayo Clinic.

Higgins and Kittel (16) working together in London 1930 stated that they observed sclerosing qualities in sodium morrhuate while using it for other therapeutic purposes. They used it in 187 cases with good results, no necrosis and only 13 cases of periphlebitis. Sodium morrhuate is a salt of a fatty acid extracted from cod liver oil. In solution it is dark brown, of a soapy consistency and has the characteristic smell of cod liver oil. They had it prepared for them by British Drug Houses Ltd. in strengths of 5% and 10%.

"Sodium morrhuate has no toxicity in amounts of 12cc of 10% solution. The vein at the site of injection becomes swollen and hard within a few moments for a distance up to an inch. On withdrawal of the needle the puncture seals itself immediately and this enables one to make several punctures in succession if necessary. It has no necrotic reaction to the subcutaneous tissues. The reaction of the vein produces very little discomfort. There is usually an aching sensation and a feeling of stiffness, which may persist for twenty-four to forty-eight hours, but it is seldom at all severe". These men state that the reaction in the vein is seen immediately and that it possesses the qualities of other irritants without the pain and discomfort of many of them. The 5% solution is used first and if results are not satisfactory, the 10% solution is used.

Wright (17) of London reported equally satisfactory results with sodium morrhuate in 3-5-10% solutions. Smith (9) reports the use of this solution in 2000 cases with good results and no sloughs. He states that the incidence of recurrence with this and quinine and urethane is less than with any other solutions he has used. Tumick and Nach (18), who report on 200 cases with the use of sodium morrhuate, tell us that it was first made by Sir Leonard Rogers (19), who used it in the treatment of surgical tuberculosis. To anyone interested in its chemical and physical properties, I refer him to Rogers' work. These men (18) describe an ideal solution as one least likely to produce a slough, pain after injection, and the one producing a good firm thrombus which is lasting and not painful in the vein. They say that sodium morrhuate is the nearest approach to that solution.

I am not including in this paper a discussion of lithium salicylate 30% with tutocaine $\frac{3}{4}\%$, metaphen 1/5%, and sodium glu-

conate 30-40% and many other solutions reported in the literature. It is probable that some of these solutions will become popular, but thus far they have not been used by a sufficient number of men to be included here. At the present time my opinion is that the best solutions we have are quinine and urethane and sodium morrhuate. Quinine and urethane produces a slough it is true, it cannot be used in certain individuals because of the toxic reaction it gives, and it can only be used in small quantities, but it has a perfect mortality up to date and has a good percentage of cures. I believe sodium morrhuate should be given a fair trial by anyone doing this work because from reports it has a very good record and does not produce either pain or slough. It undoubtedly is the solution of choice, but it has not been used in large enough series of cases yet that I am entirely satisfied with it. 50% glucose started with a similar reputation, but it does not produce a good obliteration in all cases. Only time will tell what sodium morrhuate will do in the field of injection of varicose veins. Since we have concluded that quinine and urethane, and sodium morrhuate are the solutions of choice, the next thing to consider is the technique of injection.

The technique is relatively universal, with each man giving his personal modifications. Some of the men have the patient lie down during the injection, others have him stand, while still others have him sit. Previously when I discussed indications and contra-indications, I stressed the need for careful examination of each patient before beginning injection, but I did not include the test for patency of the deep veins of the leg. First, let us consider the flow of blood in varicose veins. The venous blood of the lower extremities is normally returned to the heart by the deep and superficial veins. The superficial veins are connected with the deep veins by communicating veins. These communicating veins are pro-

vided with valves which normally prevent the flow of blood from the deep veins outward. The long saphenous vein is likewise provided with valves which normally keep the flow of blood from going downward or toward the foot. If for any reason the valves in either the long saphenous vein or the valves in the communicating veins do not function, then the weight of the column of blood from above causes the superficial veins to dilate. These veins unlike the deep veins do not have the muscular contraction to empty them. McPheeters and Rice (20) state that there are three factors which aid in the return of blood to the heart from the lower extremities. (1) The muscular contraction which forces the blood up. (2) The negative pressure in the abdomen produced by raising the diaphragm in expiration. (3) The competent valves which prevent the blood from flowing distally. If the valves become incompetent the superficial veins begin to dilate. The blood slows, more or less stasis takes place, the veins keep dilating and the valves become less competent. Hence, we have varicose veins. Sooner or later ulcers form because of little lakes of stagnant blood in the tissues which become infected after a slight bruise. Through the experience of men who have injected these veins we have learned that the veins can be obliterated, thereby causing the blood to pass from the extremity by way of the deep veins.

Before these superficial veins can be injected with a sclerosing solution, we must make sure that the deep veins are not obliterated. Probably the three best tests we have for determining that are the "Trendelenberg", the "Perthe's", and one in which the leg is bandaged from the toes forcing all the blood out of the veins and having the patient walk a block or so. If the patient returns from the walk complaining of severe pain in the leg, this is a sign that the deep veins are obliterated and the superficial veins should not be injected. If however, the patient returns with no feeling

of discomfort in the bandaged leg, one is safe in injecting the veins so far as the deep veins are concerned.

The Trendelenberg test is well described by McPheeters, Merkert and Lundblad (21). The patient lies down with the leg elevated. Gravity removes the blood from the veins. A tourniquet is applied about the upper or middle thigh and the patient is allowed to stand. In any well developed case the veins above the tourniquet will fill rapidly but the ones below the tourniquet will remain empty. If when the tourniquet is removed suddenly, the veins fill rapidly, it is concluded that they fill from above. This is called Trendelenberg positive. Now if after the tourniquet is applied the veins fill quickly from below, it means the communicating valves are incompetent and the blood is flowing from the deep veins to the superficial. This is called Trendelenberg negative. If the veins fill quickly from below and then also fill from above when the tourniquet is removed, it means that the valves in the superficial veins and the communicating veins are both incompetent. This condition is called a Trendelenberg double positive. Occasionally the veins of the lower extremity become dilated but the valves are still competent. Then when a tourniquet is applied the veins fill slowly from below. This is called a Trendelenberg Nil.

Perthe's test is done by putting a tourniquet on the leg and having the patient raise up and down on his toe six or eight times to contract the muscles in the leg. If the deep veins are obliterated the veins below the tourniquet will fill quickly and pain in the leg will be experienced.

After using the Trendelenberg test and the Perthe's test in Dispensary, I concluded that the safest method is the bandaging of the leg. It takes considerable experience for one to be able

to tell on every patient just how the veins fill and whether they are filling from below or above. With the bandage method there is no doubt as to whether the deep veins are open or not.

The technique described by McPheeter (22) in 1927 is the one I prefer. This one I adopted after reviewing the technique of most of the men doing injections. After determining that the patient is a fit case for injection, use a Luer syringe 5-10cc size and a No.26 gauge needle. The larger size needle will make too large a hole in the wall of the vein. Also the bevel on the large needle is so long that if one is not clear into the vein he may get blood on drawing back, but he may shoot some fluid into the tissues from the part of the needle not entirely in the vein. Select the site of injection, sterilize the skin with alcohol, and mark the point of injection with mercurochrome. Be sure the needle point is well in the lumen. If not, do not inject. Do not inject the vein under too much pressure as this may cause an oozing upon withdrawal of the needle and if the varix is thin walled, the vein may rupture with an effusion of the fluid into the tissues. Leave the needle in one minute following the injection and try to localize the fluid as much as possible by the tourniquet and elevation of the leg. Immediately following the injection, press a small gauze pad over the site of injection and follow this with a bandage tightly bound. Leave the bandage on two days. It is then removed and another bandage applied for two days. These bandages keep the vein collapsed and when removed the vein does not usually fill again. With the bandage the patient always feels more comfortable for a few days. Another minor point is this; a needle inserted into the vein of a layman is a "Wound". He will feel much more secure with this wound dressed. The injection is done with the patient standing.

Smith (5) says they have a bar dropped from the ceiling by which the patient can steady himself while the injection is being made. It also makes the patient more steady and minimizes breaks in technique. Occasionally, Smith tells us, veins will dilate during injection of the fluid. This will give the operator the impression that there is extravasation of fluid. If the return of blood is good and there is no pain or discomfort to the patient, stop for a minute, but leave the needle in the vein. The patient will experience a sense of fluid traveling toward the extremity and the injection can be resumed. Schmier (8) has had recurrences after injection of large penetrating veins. This type of vein he injects by putting two tourniquets on and injecting between them. This he does by applying the tourniquets with the patient lying down, inserting the needle, removing the proximal tourniquet to allow the blood to escape, then applying the tourniquet and injecting. Schmier (8) has a scarification process he advocates for the real fine horsehair type of veins. He inserts a fine straight intestinal needle into the lumen of the small vein. Then by a light touch turns the needle around the wall of the vein until a complete annular segment of intima is destroyed. A pressure bandage is applied for forty-eight hours and removed. He states that the vein is usually obliterated as perfectly as if it were chemically treated.

Kilbourne (23) does not inject veins around the malleoli and foot, because it is easier to cause a slough there than anywhere else. He suggests that 2cc of quinine and urethane be the maximum dose used. De Takats (7) suggests that the vein be emptied before injection to prevent too high a dilution of the solution. He keeps the legs bandaged three weeks after completing the injection to prevent canalization.

Sometimes a patient will have large varicose veins in the leg with none apparent in the thigh. McPheeters, Merkert and Lundblad (13) have a method of percussing out this vein. Place the fingers of one hand well up on the thigh along the course of the great saphenous vein. With the fingers of the other hand, percuss the large varicose loop in the leg. If the valves of the great saphenous are destroyed, the impulse will be felt on the fingers up in the thigh. These veins should be injected as well as the ones that can be seen. They explain this as one of the chief causes of recurrence. Zimmerman (25) advocates the ligation of the great saphenous up in the thigh, especially on cases with large dilated veins. He feels that this adds to the safety and reduces the pressure in the veins. De Takats and Quint (26) also use this method on large dilated veins. They start at the lowest point of the dilatation and never inject above the middle of the thigh.

With one who is injecting varicose veins it is practically impossible to keep from getting some sloughs. So until a solution has been standartized which will absolutely not cause a slough we must consider the slough. Schmier (8) gives a very good description of an imminent slough. "There is a peculiar discoloration at the site, immediately following injection. The skin acquires a blanched bluish hue surrounded by a reddish halo, and becomes dimpled or slightly invagenated at this point. This is the first sign of the escape of solution into the tissues. The observance of this sign is very valuable in patients who are very nervous and high strung, and also in patients who are below normal intelligence, in preventing a slough because the latter do not always feel the pain". Bregeliesen (27) describes five things that can happen to cause a slough. First,

the vein may be punctured in several places while searching for the lumen. Second, the needle may be lying in a hematoma and though blood is aspirated in the needle, the solution does not enter the vein. Third, the needle has a little fluid on it when it enters the tissue. Fourth, a long beveled needle may be partly out of the vein. Fifth, a thin walled vein may be torn by the pressure exerted over it after injection.

When an irritating solution gets outside the vein it is best to inject from 2-10cc of sterile water or normal salt solution immediately. This prevents a slough in a good percent of cases. De Takats (7) injects 5-10cc of the patient's whole blood into the area and he says this prevents a slough. If a slough does occur even after all precautions are taken to prevent it, the area should be treated with wet dressings of boric acid and later balsam of peru may be applied. We all hope that the sloughs will be eliminated in the treatment with the use of the less irritating solutions. With the use of sodium chloride and sodium salicylate, sloughs were very numerous. These sloughs were so severe that it was necessary to excise the area and treat that area as though it were an ulcer. With the injection treatment of veins surely we should know just what takes place in the vein after a foreign substance is introduced. Does the vein collapse? Or does the blood clot? Why is it that we can do something that is entirely contrary to nature's intentions and divert the flow of blood by way of the deep venous system? In answer to these questions let us review the works of some of the men who have done some exceedingly good work in determining what takes place in a vein when fluid is injected.

The injected fluid causes a destruction of the cuboidal cells of the intima, there is cloudy swelling, and a chemical venitis occurs with infiltration of the vein wall. Fibrous tissue is

developed through the proliferating cells of the intima. Red and white cells are deposited and a firm thrombus results. The thrombus becomes hyalinized as early as the fifth day. Capillaries bud out from the subendothelial layers, proliferating out into the thrombus and the process of organization takes place. Within a few weeks organization is firmly established and ultimately only a fibrous cord with complete obliteration of the vein is found. (28) How is this thrombosis different from phlebitis? A very satisfactory answer to this question is given by Forestier (29). He says that Jentzer and Askanzy mixed collargol in a suspension of sodium chloride and injected it into veins of animals. A few hours later the collargol had penetrated all coats of the vein and even beyond. This shows that the process of chemical irritation called venitis is substantially different from infectious irritation or phlebitis. Chemical venitis is localized, generates a very adhesive clot, does not give rise to pain or local edema and leaves an atrophied cord. In phlebitis there is extension from superficial network to deep network causing edema. The clot in phlebitis is often loose and may get into the general circulation. Atrophy does not take place, the vein remains hard and bulky and further attacks of phlebitis are possible.

After injecting the vein the intima which is normally smooth, pale and glistening, turns a velvety red with occasional subendothelial hemorrhages. De Takats (26) advocates the compression bandage because it produces a stasis which is important in producing thrombosis. It reduces the back pressure in the column of blood, and it approximates the injured intimal surfaces.

The after treatment of the injected cases is relatively very little. Usually the patient can go about his work with very little pain. It is well to observe these patients from time to time and

if other small veins show up, to inject them again. McPheeters (13) sees his patients every other day for six to ten days after injection, then in two months, then every three months and after that, yearly. De Takats (7) has the patients wear a bandage for three weeks after treatment and thinks it helps to prevent canalization. It is well to keep the patient up and exercising rather than letting him go to bed. Hot packs usually relieve moderate pain. Once in a while a patient will complain of a head ache or syncope. In these patients, have them lie down for a few minutes and these symptoms usually clear up.

With sodium chloride and sodium salicylate, a severe cramp is experienced after injection. At first it was thought that this was a vaso motor contraction of the vein, but Bregeleisen (27) thought by injecting a solution containing dye that he could give a different explanation of the cramp. The dye could be seen as it passed through the venous channel. Some of the solution went up and some down in the vein. That going down seemed to linger in the small capillaries and gradually fade away. It is during the diffusion over the surface vessels that the cramp-like pain is experienced. He thought this showed that the cramp is not due to muscular or vascular spasm. The pain depends upon the irritation of a sufficiently wide bed of venous channels. When fluid is localized to a venous channel by pressure, no cramp occurs. This is not conclusive proof of the cause of the cramp, but it is as logical a reason for the cramp as I have been able to find, so we shall accept it until a better explanation is offered. However, I believe that with the solutions now being used, the cramps are at a minimum. For after-treatment I recommend the bandaging of the leg for three weeks after finishing the injection, and treating symptomatically any complications arising.

In all the literature written on this subject the writers are very enthusiastic about this type of treatment. However, Howard, Jackson and Mahon (30) have made a critical survey of this method. Their series is hardly large enough to be of great value but still I think their work worth considering rather seriously. Out of 66 patients treated with sodium chloride by the injection method, they have followed 49 of them a year or more. 48 of the 49 showed a recurrence of their previously thrombosed veins. This made a recurrence in 98% of the patients followed a year or more and a recurrence in 79% of the patients treated. In contrast however, 49 had partial or complete relief from symptoms attributed to varicosities, and 28 of these patients got complete relief. They found that recurrence took place by recanalization, a natural pathologic response to thrombosis. They advocate the ligation of the greater saphenous vein combined with the injection. In a microscopic study of the injected veins, thrombosis after the injection of 20% sodium chloride were found to be firm and hard after twenty-four hours. Microscopic study of sections showed the lumen of the vein to be filled with a red thrombus composed of red blood cells. The intima was destroyed and the regularly spaced endothelial cells were visible only in small portions of the vein. Fine threads of fibrin reached out from the wall of the vein into the thrombus. Forty-eight hours later the red cells were collected into large irregular homogeneous groups. The cell outlines were in-distinct and innumerable fine pigment granules were seen throughout the thrombus, which tended to collect about white cells, fibrin threads and hyalin bluish lines of Zahn.

Seventy-two hours later the fibrin network of the thrombus was made more distinct by the collection along the fibrin strands of the pigment granules. Phagocytic granules invaded the thrombus

and an occasional endothelial cell could be made out near the periphery of the thrombus.

Six days after injection the thrombus showed the red cells to be in homogeneous masses with indistinct cell outlines. Leukocytic infiltration of the thrombus was well advanced, and the pigment granules were found in larger masses within the phagocytic cells. But cleavage spaces had appeared between the thrombus and the wall and were filled with red blood cells.

Nine days after injection the thrombus had retracted from the wall, leaving two large crescentic spaces filled with blood cells. The thrombus was beginning to be infiltrated with tiny capillaries and endothelial cells along the fibrin strands into the thrombus.

Thirteen days after thrombosis, the thrombus was still composed mainly of hyalin homogeneous masses of red blood cells with faint outlines, and leukocytes caught in the fibrin network. The thrombus had separated from the wall and remained attached only by a broad pedicle. The new vessels were relatively large and all contained fresh blood cells.

Three weeks later the center of the thrombus was still composed of hyalin masses and the lacunar spaces at the periphery were lined with endothelium and were filled with fresh blood. The new vessels growing in were accompanied by fibroblasts.

Five weeks after thrombosis, the thrombus was invaded with vessels and definite organization had advanced a short distance into the thrombus. A bridge of organized fibroblastic tissue bisected the center of the thrombus. In eight weeks complete organization had taken place. The site of the previous intimal coat was marked by newly formed tissue composed of small capillary vessels, large blood vessels that formed distinct vascular sinuses, and by a marked invasion and proliferation of fibroblasts. Although or-

ganization was almost complete, there was an irregular lumen about one-third the size of the original lumen, running through the thrombus. It was lined with endothelium, and its walls were formed by fibroblastic tissue of the organized thrombus. A pedunculated mural thrombus could be seen.

Eight weeks after thrombosis, the fatty tissue about the adventitia had areas of dense perivascular round cell infiltration. Numerous blood spaces lined with endothelium and containing fresh blood had appeared. One large circular blood space, a fifth the size of the lumen was patent.

Three and a half months after thrombosis with sodium chloride and dextrose there was a proliferative endovenitis concentrically narrowing the vessel lumen by about one fifth. The remaining four-fifths of the lumen contained fresh red blood cells. There was a definite laying down of fibrous tissue along the delicate new blood vessels, and the fresh red blood cells were found between the meshes of the fibrovascular tissue. There was a marked perivenitis with pronounced perivascular round cell infiltration in the adventitia and surrounding fat.

Four and a half months following thrombosis the adventitia showed a moderate perivenitis. The fibrous tissue and blood vessels narrowed the lumen by about one-fourth. The remainder of the vessel was patent and contained fresh blood.

Nine months after injection with sodium salicylate, complete fibrosis and organization of the thrombus had occurred. The strands of fibrous tissue and nuclei were arranged in a radial direction from the center of the lumen, and only small blood sinuses were seen. This patient had had three operations for varicose veins and the vessel thrombosed was a single isolated one between the scars of the previous operations.

Ten months after injection with 20% sodium chloride, the wall of the vessel still showed the site of the old intima marked by the beginning of a dense fibrous tissue with the fibrin bundles and nuclei pointing toward the lumen. At the junction of the old intima and the fibrous tissue, there were numerous vessels and small blood sinuses. A good sized lumen about one-third the size of the old lumen was lined with endothelium.

The men named above deserve considerable credit for this extensive work and it is very interesting to read what takes place after fluid is injected into veins. However, I wonder if some of the descriptions of recanalization given were not merely a process of organization taking place which were misinterpreted. During the process of organization of a thrombus very similar conditions occur as were described by them. Then again I see no harm in the recanalization if it does take place, for has not the patient benefited probably more than if he had not had the injection. On the basis of the thought that the restoration of the lumen in a vein is an end result of constant pressure from above, and considering the simplicity of ligation of the long saphenous, probably there are some patients upon whom a ligation is indicated. As we are taught all through medicine, no hard and fast rule can be layed down regarding the treatment of varicose veins. But I believe in those patients whose veins are not too large and saccular, ligation is not indicated and that we can assure at least worth while relief with injection.

In 1929 Kilbourne (23) sent out a questionnaire to men who had been doing the most work in the varicose vein field. This questionnaire regarded the recurrences of varicose veins after injection. The average recurrences in some 35000 cases was 6%. Forestier reported the highest percentage of recurrences which was 15%. In a

series of 1400 patients treated by operative methods, there was 30% failure reported.

Stoner (31) thinks Howard, Jackson and Mahon (30) are not justified in saying 98% recur. He quotes a personal interview with McPheeters who likened varicose veins to decayed teeth. He says, "You may get your teeth fixed but others will decay even though all teeth appeared in good shape previously." McPheeters, Merkert and Lundblad (13) explain that there are many factors the operator must control in order to prevent recurrences and fatalities in the injection treatment. For example, they think there is so far, no one solution which is efficient in sclerosing all types of veins. The strength of the solution should be controlled, the size of the vein makes a big difference as to the type and amount of a solution to be used. The solution injected should be localized long enough to cause an irritation to the intima of the vein before it is diluted. If 5cc of quinine and urethane is injected into a vein three-fourths inch in diameter, it is diluted a hundred times the instant it is injected. The age of the patient, the location of the injection, and whether or not the patient has been treated before, are important factors to be considered to prevent recurrences.

The whole vein should be sclerosed by multiple injections. If the saphenous vein is not sclerosed clear to the opening into the femoral, there is apt to be a recurrence. The valves of the femoral vein can be tested by the percussion method as described previously. In 1928, McPheeters and Rice (28) removed some sclerosed veins and pathological studies showed a definite line of demarcation between the saphenous vein and the femoral. They explain that they have never seen at autopsy the intima of the femoral vein injured due to solutions. The sharp line of demarcation

seen at the sapheno-femoral opening is due to the fact that as soon as the solution goes as far as the femoral, the high dilution by blood in the femoral prevents any harm to that vessel.

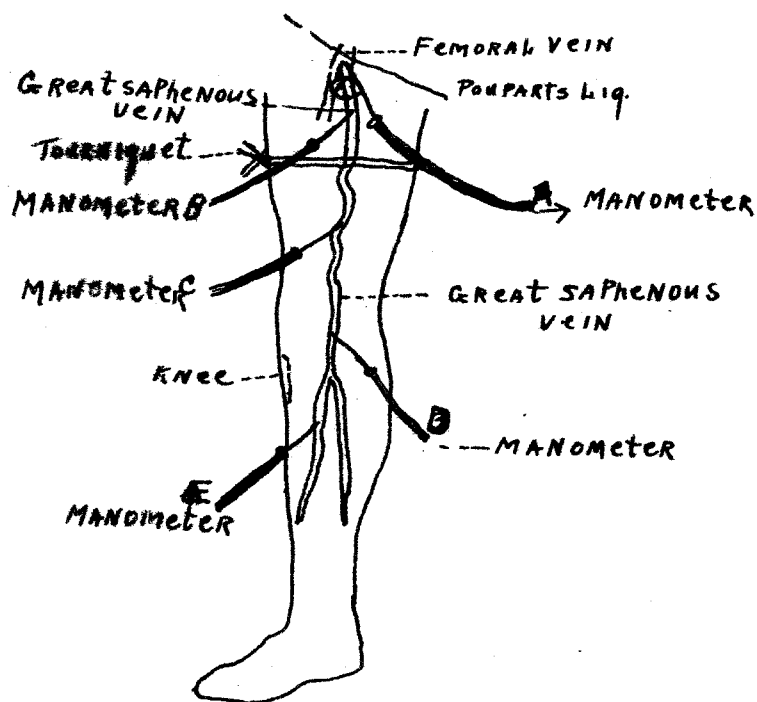
Kern (33) followed 100 patients for eighteen months and reports a recurrence of the old varices in 10%, 7% partial and 3% complete recurrences. He believes recurrences are early and are due to incomplete thrombosis in a majority of cases. Pennoyer (34) reported some recurrences but explains them by saying it is due to the original predisposing cause of the varicose veins still being present, and not the fault of the injection.

Until a better treatment for varicose veins has been found, I believe we should not deny patients this service, but instead of promising to cure all of them they should be told that about 6-10% of the patients who have had injections have recurrences.

The first thought that comes to the mind of the novice in this treatment is this: how can a thrombus be formed in a vein, without running a big risk of this thrombus breaking away and getting into the general circulation? There has been considerable discussion in the last few years regarding the direction of flow of blood in varicose veins. In 1929, McPheeters and Rice (20) undertook a bit of experimental work to prove that the method of injection of a sclerosing solution into the blood stream with the idea of producing a thrombus, is not unscientific and unsurgical as it seems to most of us. By the injection of lipoidal into varicose veins, then observing them under the flouriscope, they concluded that in early cases of varicose veins, in which the valves are still patent, there is a stagnation of blood. In the moderately advanced cases the blood flows downward in the superficial saphenous and into the deep veins through the communicating veins, the valves of which are still normal. In the advanced

cases, the valves in both the superficial and deep veins are destroyed and in these the blood flow is either reversed or stagnant. Therefore a chemically induced thrombus is either forced distally toward the smaller branches or remains stationary. At that time the above named men decided this was the reason an embolus in injected cases was so unusual. In 1932, McPheeters, Merkert and Lundblad (21) reported further experiments and furnished further proof for the above conclusions. In discussion they liken the muscles of the lower leg to those of the heart. When the muscles of the leg contract, the blood is forced through the deep veins into the deep femoral vein. During the period of relaxation, the deep veins of the lower leg are nearly empty and are waiting to be filled. When the patient is standing with all muscles tonic, the venous flow is upward similar to the overflow of a spring. Just as soon as the patient begins to walk the systolic contraction of the muscles of the lower leg empties the deep veins of the calf. By the use of fine mercury manometers, McPheeters et al (21) recorded the respective pressures in the great saphenous vein while the patient was prone, standing with a tourniquet on, standing with tourniquet off--5-10-20 seconds respectively--the patient grunting, stepping, during inspiration, and during expiration. The diagram shows the different points in the saphenous vein at which needles leading to manometers are inserted. The table shows the readings and the results of the various maneuvers. By the injection of lipiodol and examination under the fluoriscope, the results paralleled what occurred in the blood pressure readings.

Skiodan is also a substance used for the same purpose.



The blood pressure reading as recorded from McPheeters et al Cases (21)

	<u>E</u>	<u>D</u>	<u>C</u>	<u>B</u>	<u>A</u>
Prone	7.0mm	Same as E	8.0mm	14.5mm	17.5mm
Standing tourniquet on	30.0		13.2	22.0	40.7
Standing tourniquet off	36.8		15.5	25.0	42.7
Five seconds	33.3		28.7	42.6	71.3
Ten seconds	35.6		34.0	56.6	72.3
Twenty seconds	35.6		40.0	64.6	73.6
Grunting	46.0		44.0	81.0	88.0
Stepping	42.0		36.0	36	61.0
Inspiration	42.0		32.0	?	?
Expiration	44.0		33.0	?	?

A review of the earlier literature leads one to believe that deaths from injection treatment are very rare. However, in the last four years the deaths from injection treatment have rapidly increased. This is probably due to two things. First, less irritating solutions have been used, and second, due to the abundance of literature being written, so many more men are using the treatment. I wish to impress it upon any readers that, though this

this treatment is relatively simple, it should be done with the care and conscientiousness that all surgical procedures require.

I wish now to review the fatalities which have been reported. As I mentioned at the beginning of this paper, fatalities are hard to report, unless one has had enough cases to make the percentage low, or unless one has had sufficient experience in other fields that the reporting of a fatality will not mar his reputation. In so far as possible I have tried to classify the causes of death in order that some conclusion might be drawn as to what solutions have been used, the age of the patient and the cause of death. We are indebted to McPheeters and Rice (28) for an excellent report of fatalities up to 1928. At that time they stated that they were unable to locate more than seven deaths directly attributed to the injection treatment. They reviewed 53000 cases which made the mortality .00024%. Of course the most common fear is that of a pulmonary embolism. However only 4 of the deaths reported were due to this cause.

Case I Olson O.A. JAMA 89:692, 1927

Mrs E. C. age 31, extensive varicose veins, duration 6 years cause pregnancy, June 3, five injections of 10cc each of 25% NaCl in Right leg. Four injections 10cc each, 50% invert sugar solution. June 8th patient discharged with perfect result. June 13th patient suddenly dropped dead at 5 P.M. Pulmonary thrombus thought to be of less than 24 hours duration. Cause probably sugar solution.

Case II

Hohlbaum Case, 60cc of Pregl's solution was injected into one large vein. Fourteen days later patient died, pulmonary embolism. Autopsy confirmed the clinical diagnosis.

Pregl's solution comes under the group of coagulating solutions and McPheeters and Rice believe it should not be used. Injury and

stimulation to the vein wall is the thing desired rather than coagulation of blood.

Case III

Lomholt reported a case age 60 given five injection of 5cc 20% NaCl at short intervals. On the twelfth day after an onset of soreness and pain at the site of injection patient developed phlegmasia alba dolens and died on thirty-third day of pulmonary embolus.

Case IV

Faure -- report of a death but they were unable to get the details of this case.

Case V

Levai -- a case developed a septic thrombo-phlebitis following injection and finally died.

Case VI

Hammer -- woman age 36. 1cc of 1% mercuric chloride injected. Developed gastric symptoms, diarrhea, bloody discharge and died twelve days later. No Postmortem. Cause mercurial poisoning.

Case VII

One of their own series, Mrs H. S. varicose veins 30 years. Treated with 20% NaCl. Slough, excised, died twenty-six days later. No Postmortem. Cause septicemia.

Case VIII

Nobl-Husch case. Injected with 66% grape sugar solution. Six weeks later operated for hemorrhoids. Three days after operation, straining at stool, suddenly died. Cause pulmonary embolism. Autopsy - Probably due to operative procedure.

Case IX

Professor Schonhoff of Prague - Case. Varices injected with NaCl, one month later died of pulmonary embolism. Professor Schonhoff thought this death due to an embolus from thrombosed hemorrhoidal knots.

Case X

Eiselsberg's patient treated with a concentrated sugar solution. Excised a thrombosed knot and ligated the saphenous. The patient died ten days later upon leaving her bed. Cause - probably infection following operation.

Case XI

Redner - a nonfatal case, bilateral femoral thrombosis following injection. Symptoms of lung embolus. Recovery.

Case XII

C. S. Varicose veins fifteen years. Dec. 30, 1927
90cc of 20% NaCl injected into segments of veins. Two areas of slough, incised, hot packs, admitted to hospital. Jan. 19th patient began having epigastric pain, required morphine. Died Jan. 23rd. Post mortem negative. Possible cause of death, coronary disease, toxicity from NaCl, mother daughter embolism.

Kilbourne in 1929 (23) cites two more cases not appearing in McPheeters and Rice series.

Case XIII

Man age 74, who had been in the tropics, was treated. He died but no cause was determined at autopsy. It should be the injection of an organism weakened by the tropics. Solution NaCl.

Case XIV

Man age 54. Injected with sodium salicylate in right leg, died one and a half months later with symptoms similar to pulmonary embolism.

Case XV

Kuhnau is reported by Silverman (35) as having a fatality after injection of 60cc of Pregl's solution.

Case XVI

Linser, reported by Silverman (35) a fatality after injection with NaCl.

Case XVII

Anschutz - Lohr by Silverman (35) a fatality after injection of 15cc of 20% NaCl. 1929.

Case XVIII

Mundt 1930 (36) reports a fatality after a total of 25cc of 1% mercuric iodide with 1% sodium iodide was injected.

Case XIX

Green and Green (37) reported a case, the cause of death being thyroid crisis following injection treatment of varicose veins. The patient was refused treatment by these men but was treated by another physician.

Case XX

Gillispie and Strobel (38) reported a case aged 40, which was fatal after an injection of varicose veins. These men stated that they used 20% NaCl and 70% glucose or the combination of the two for injections, but did not state which was used in this case.

Cases XXI - XXII - XXIII - XXIV

Stoner (31) tells of four deaths occurring in different parts of Iowa after the injection of varicose veins. He is unable to give us many particulars of these cases so we will just accept the number as he gives it.

Case XXV

I heard of one case in Nebraska but have been unable to obtain any details on it.

I believe this brings reported fatalities up to 1933. If any of my readers know of others I have not included in this list, I should like to be notified, in order that this list will be as complete as possible.

In summarizing our fatalities as to solutions used, we find that in 8, NaCl was used. Pregl's solution in 2, mercuric chloride in 1, sugar solution in 2, sodium salicylate in 1, mercuric iodide and sodium iodide in 1. We have nine we are unable to give definitely what solution was used. From these figures, NaCl is the solution responsible for most of the deaths, but that means nothing because we have no way of getting the percentages compared to the total number in which the different solutions were used. I merely present these fatalities to show that the injection treatment is not without its dangers. Kilbourne, Dodson and Zeiler (14) give us a fact which must be faced. "In fifteen years before January 1, 1927, with modern solutions, there had been reported two deaths from sepsis and embolism in 45000 patients. In the past four years there have been fifteen deaths from sepsis and embolism reported, due to injection treatment, not counting one other fatality following injection, in which there was no doubt as to whether vein injection or other factors caused the pulmonary symptoms". Now what conclusions can we draw from this statement? To me it is this: for sometime the less irritating solutions were blamed for fatalities, but sodium chloride is anything but non-irritating. The increase in fatalities in the last few years is not because more patients are being injected, but because more men are doing the injections. For proof of this we have statements from the men running large series of cases that they have had no fatalities. Some of these are: Linser 6000; Genevrier

4000; Nobl 3000; Donthwaite 2000; Schmier 3000; Scott 10000. The mortalities have come largely from inexperienced workers. This need not be discouraging to men beginning the use of injection treatment but it should be a warning to us to study and follow carefully the technique of men who have run large series of cases successfully.

In conclusion I wish to say that I am convinced that there is a lot of good to be done for varicose veins by the injection method. ~~Each patient should have a thorough physical examination.~~ Each patient should have a thorough physical examination. Special attention should be given to cardiac or cardiorenal dysfunction, patients with acute thrombo phlebitis should not be injected, be sure the deep circulation is open and we should look for enlarged veins over the abdomen. Bergers disease is a contraindication. Patients with acute infections, hypertension and recent operations on the pelvis should not be injected. Quinine should not be used in pregnancy and during menstruation. Diabetics should be sugar free before injection is done.

I believe the bandaging of the leg is the best way to determine the patency of the deep circulation.

Quinine and urethane and sodium morrhuate seem to be the best drugs to use for injection. 2cc of quinine and urethane should be the maximum dosage. Sodium morrhuate is best used in 5-10% solutions in total dosages under 12cc.

As to technique, most men prefer a 5-10cc Luer syringe with a 26 gauge needle. The injections should be made with the patient standing. After injection, firm pressure should be made over the injection site and the leg kept bandaged for three weeks after injection is finished. When there is a perivenous leakage with a solution that causes a slough, inject 5-10cc of sterile water or normal salt solution at that site. It may prevent a slough.

Sclerose the whole vein before dismissing the patient and tell him to return with any new varicose veins that should appear. All injections should be done as a surgical procedure, taking care to observe aseptic technique at all times.

It seems that the success of men reporting large series of cases is due chiefly to the observance of technique, and to their judgment in the selection of cases to be treated. This is not a difficult procedure and is available to a large group of patients.

It should give the physician satisfaction to be able to help people who have suffered for years with varicose veins and varicose ulcers. Until the ideal solution has been discovered, let us all try to preserve this treatment which has helped so many.

Note

Since having this paper printed I have obtained permission from Drs. B. B. and Herbert Davis to use the history form used in their office. I find it a more complete history than the one used by Dr. Kilbourne on pages 6 and 7. This history is found on pages 38 and 39.

VARICOSE VEINS

Name
Address
Age
A. Etiology

Office No.

Varicose Vein No.

1. Sex
2. Limb: Right Left Both
3. Race
4. Occupation
5. Age at onset
6. Endocrine insufficiency—varicose diathesis.
 - (a) Hereditary
 - (b) Thyroid enlargement—Changes in emotions, vitality, activity.
 - (c) Acromegally—pituitary insufficiency.
 - (d) Increase in size of veins with menstruation
7. Pregnancy—Number of Children
 - (a) Early—before 3 months is endocrine.
 - (b) Late—after 3rd month is pressure.
8. Back pressure { increased abdominal pressure
 pelvic growth
 elastic about limb
9. Severe febrile disease with asthenia
10. Trauma
11. Syphilis

12. Infection {

{	Thrombophlebitis of deep veins	{	pregnancy
	Typhoid		typhoid
	Diphtheria		septicaemia
	Pellagra		other cause
	Influenza		
	Bronchitis		
	P. I. D.		
	Rheumatism		
	Scarlet fever		
	Pneumonia		
	Other infections		
13. Location of first enlargement
14. Previous excision of veins.

B. Symptoms:

1. Presenting complaint.
2. Enlarged veins
3. Swelling of legs
4. Pain {

{	{	aching
	{	burning
	{	severe
	{	
	{	constant
	{	intermittent
5. Itching
6. Tight feeling in legs
7. Tired feeling in legs
8. Subcutaneous hemorrhages—hemorrhagic varices
9. Hemorrhage from vein
10. Ulcer {

{	duration
	number times healed
	previous treatment
11. Hard veins
12. Amount of disability

C. Physical examination:

1. General {

{	Foci of infection
	Pelvic growth
	Tight elastic about limb
2. Local:
 - (a) Location
 - (b) Size of veins
 - (c) Type of veins {

{	Uniform dilatation
	Serpentine varix
	Saccular varix
	Skyrocket
 - (d) Stage {

{	1. Early—tissues unchanged
	2. Moderate severity—fair circulation (may be ulcers)
	3. Late—advanced malnutrition of tissues
 - (e) Skin changes {

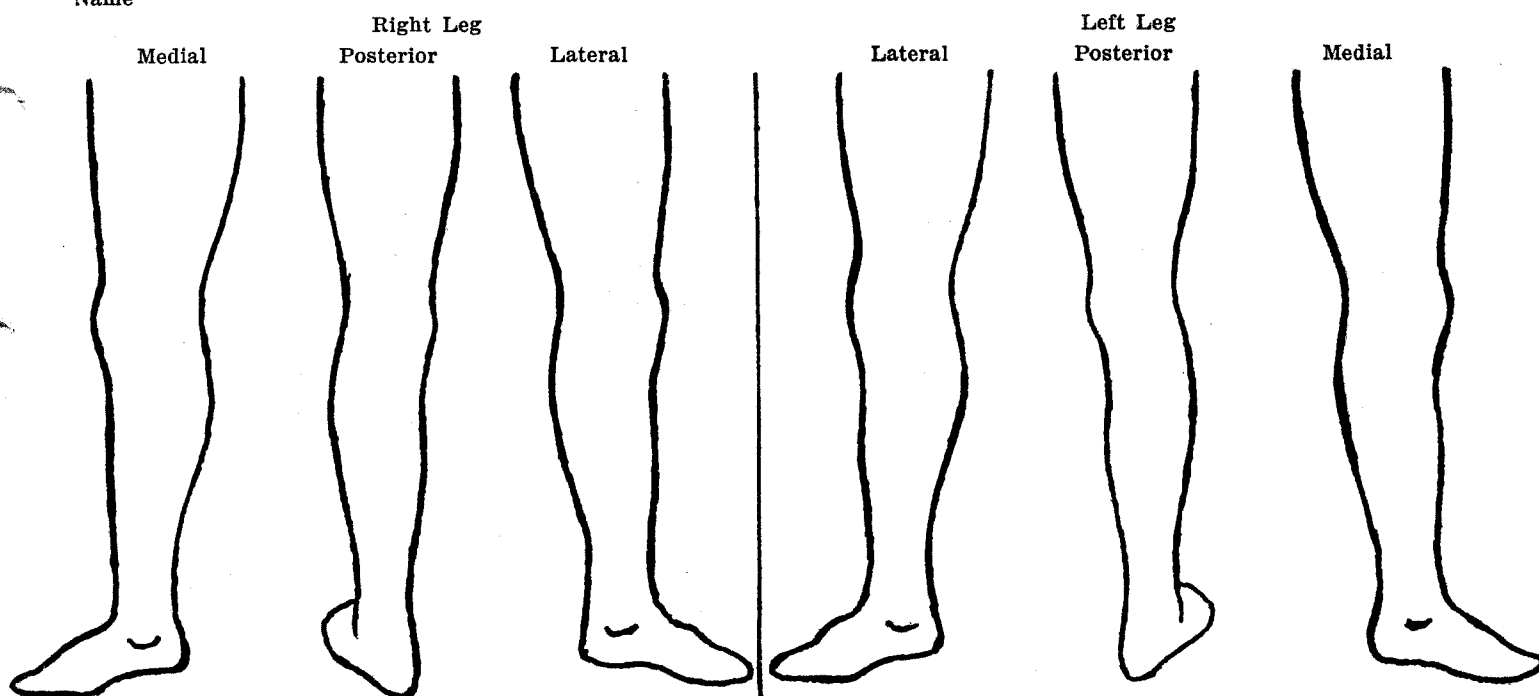
{	Scaly atrophic								
	Hyperkeratosis								
	Eczema								
	Pigmentation								
	Ulcer { <table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="font-size: 4em; vertical-align: middle;">{</td> <td>Location</td> </tr> <tr> <td></td> <td>Size</td> </tr> <tr> <td></td> <td>Feeder vein</td> </tr> <tr> <td></td> <td>Circulation about ulcer</td> </tr> </table>	{	Location		Size		Feeder vein		Circulation about ulcer
{	Location								
	Size								
	Feeder vein								
	Circulation about ulcer								
 - (f) Subcutaneous tissue {

{	Oedema
	Induration—fibrosis
	Cellulitis
 - (g) Periostitis

VARICOSE VEINS

No.

Name



(h) Tests of circulation

1. Pratt test Positive
2. Trendelenburg test Negative
- Double Nil
3. Perthes' test { Competent communicating valves
Incompetent saphenous valves

D. Contraindications to injection treatment

1. Obstruction or incompetency of deep veins
2. Active thrombophlebitis
3. Focal infection
4. Pregnancy and three months following
5. Diabetes
6. Obstruction of iliac veins or inferior vena cava
(Collateral varices over abdomen)
7. Cardiorenal disease. { Raynaud's disease
Thromboangiitis obliterans
8. Arterial disease of extremities { Arteriosclerosis { Senile
Diabetic
Syphilitic arteritis
Periarteritis nodosa

E. Treatment

1. Operative excision
2. Ligation of saphenous longus vein
3. Injection:
 - a. Glucose
 - b. Sodium chloride
 - c. Quinine hydrochloride and urethane
 - d. Sodium salicylate
 - e. Combinations of above

F. Reaction from injection

1. First degree—simple thickening without obliteration
2. Second degree—complete occlusion without perivascular reaction.
3. Third degree—complete occlusion with perivenitis

G. Untoward symptoms of injection treatment

1. Immediate
 - (a) Cramping
 - (b) Pain at site of injection
 - (c) Toxic symptoms { Palpitation
Dizziness
Nausea
Other
2. Late
 - (a) Necrosis
 - (b) Perivenitis
 - (c) Hematoma
 - (d) Embolism

H. Results of treatment

1. Veins—obliteration
 - Duration of { hard veins
discoloration of skin over veins
2. Symptoms
3. Tissue circulation
4. Ulcer

I. Results one year later

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